

**MICRO MODE EXECUTING APPARATUS OF DIGITAL STILL CAMERA  
USING FOCUS DRIVING MOTOR**

**BACKGROUND OF THE INVENTION**

5      Field of the Invention

The present invention relates to an electronic still camera, and in particular to a micro mode executing apparatus of a digital still camera using a focus driving motor, in which an image sensor and a focus controlling lens are  
10      connected to a focus driving motor and a spindle of the motor, thereby controlling an optical length within a range of not changing a barrel structure.

Description of the Prior Art

15      Recently, while electronic still cameras recording a still image on a magnetic disc in a form of an electrical image signal has been developed, the electronic still camera has to control the focusing by moving a focus ring of the photographing lens such as a typical still camera using a  
20      silver-salt film.

In that case, the automatic focusing control may be performed by an automatic focus mechanism. The automatic focus mechanism detects a distance from the camera to a subject to move the focus ring of the photographing lens  
25      based on the distance information.

EXPRESS MAIL CERTIFICATE

Date 5/14/01 Label No. 2853601573US

I hereby certify that, on the date indicated above, this paper or fee was deposited with the U.S. Postal Service & that it was addressed for delivery to the Assistant Commissioner for Patents, Washington, DC 20231 by "Express Mail Post Office to Addressee" service.

D B Peck  
Name (Print)

[Signature]  
Signature

Meanwhile, in a video camera, a photographing signal itself detects a focus information for an automatic focus control to perform the automatic focus control without detecting the distance. Specifically, when the focus control  
5 of the lens is proper, since the profile of the subject can be photographed distinctly, a high band of a frequency component is not contained in the photographing signal. When the focus control of the lens is not proper, since the profile of the subject is blurred, a high band of a frequency  
10 component.

Accordingly, the automatic focus control is performed by detecting an amount of a high band of a frequency component contained in the photographing signal to determine whether the state of a present focus control is proper or not.

15 A zoom lens is widely used as a photographing lens mounted onto the camera. Using such a zoom lens, a focusing distance may be successively varied, so that a photography can be achieved in an optional viewing angle between a wide angle and a telescope angle.

20 However, in the zoom lens, if the focus distance is varied, there is a problem in that the focus position is also varied. Specifically, since it adjust accurately the focus of the subject before varying the focus distance, although there is no the variation of the distance from the camera to  
25 the subject, the focus of the subject is deviated, if the

focus distance is varied.

In the typical zoom lens, in order to prevent the focus from being deviated, if a zoom ring for adjusting a focus distance rotates, the a focus adjusting lens is gradually  
5 moved by components such as a cam groove, so that the focus position may be compensated in line with the variation of the focus distance.

As shown in FIG. 1, in a high-grade camera, an application of a micro mode increases to photograph an object  
10 not far off a limited distance predetermined in a lens design. Such a micro mode photographs a near object by extending a total length of a camera optical system, with submitting to the degradation of a photographing performance of the lens.

With reference to FIG. 1, a position of the focus on  
15 which the object OBJ is photographed on a position of a normal lens is designated by a reference numeral F1. At that time, if the lens is moved forwardly, the distance between the object OBJ and the lens is shortened to vary the position of the focus to be photographed.

Accordingly, although the lens moves substantially,  
20 supposing that the position of the lens is fix as shown in FIG. 1, the object OBJ moves relatively to the lens to produce a virtual image of the object designated by a reference numeral IOBJ. Therefore, the focus to be  
25 photographed by the virtual image of the object is positioned

as a reference numeral F2.

Specifically, in the electronic still camera, in order to move the lens from or to the image sensor, the camera has to have two lenses as shown in FIG. 2, and a transferring  
5 guide member having a barrel structure to transfer each lens has to be provided.

The application of the micro mode of the conventional electronic still camera will be described with reference to FIG. 2.

10 The focusing mode of the conventional electronic still camera includes an object lens  $L_o$  faced to the object, and an image lens  $L_i$  faced to an image sensor IS. The focusing mode is determined by transferring any of the lenses.

In case of transferring the image lens  $L_i$  to apply the  
15 micro mode, there is an advantage in that since the image lens and the object lens have a stable position due to the solidity of the barrel structure as shown in FIG. 2, the performance of the camera can be constantly maintained. Also, the transferred image lens is secured to have an optical  
20 stability.

However, there is a disadvantage in that since the distance between the image sensor and the object lens is fixed, the camera does not satisfy the anticipation of the micro mode.

## SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a micro mode executing apparatus of a digital still camera using a focus driving motor, in which an image sensor and a focus controlling lens are connected to a focus driving motor and a spindle of the motor, thereby controlling an optical length within a range of not changing a barrel structure.

To achieve the above object, according to one aspect of the present invention, there is provided a micro mode executing apparatus for a digital still camera, the apparatus comprising: a focus lens and an image sensor arranged sequentially with an optical axis passing through centers of the lens and the sensor; transferring means, provided integrally on the image sensor, for transferring the focus lens along the optical axis; a first transferring area defining portion for defining a transferring area of the focus lens transferred by the transferring means; a second transferring area defining portion for defining the transferring area of the focus lens transferred horizontally along the optical axis by the transferring means, when the focus lens is not further transferred by the first transferring area defining portion; and transferring movement limiting means for preventing the image sensor from transferring when the focus lens is transferred in an area

defined by the first transferring area defining portion according to the operation of the transferring means.

According to another aspect of the present invention, there is provided with a micro mode executing apparatus for a digital still camera, the apparatus comprising: a motor transferred along a rotating axis of a spindle with a rotating direction of the motor being changed in line with an applied electrical signal with reference to the rotating axis of the spindle; an image sensor, mounted integrally onto one side of the motor through a fixing member, for converting an image of an object to be photographed to an electrical signal; a focus lens positioned on a same optical axis as the image sensor and secured to one end of the rotating axis of the spindle; a housing consisting of a first step region for limiting a transferring area of the motor and a second step region for limiting a transferring area of the focus lens, the first and second step region forming a barrel structure having a step layer; a first biasing member connected to the focus lens and the motor and having a constant biasing force; and a second biasing member for positioning the motor on the first step region by applying a biasing force to a lateral direction.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

The above objects, features and advantages of the

present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a view illustrating a micro mode;

5        FIG. 2 is a cross sectional view illustrating a barrel structure of a conventional focus controlling method;

FIG. 3 is a cross sectional view illustrating a normal state of a micro mode executing apparatus of a digital still camera having a focus driving motor according to the present invention; and  
10

FIG. 4 is a cross sectional view illustrating an expanded state of a maximum optical path of a micro mode executing apparatus of a digital still camera having a focus driving motor according to the present invention.  
15

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

Preferred embodiment of the present invention will now be described with reference to the accompanying drawings.

FIG. 3 is a cross sectional view illustrating a normal state of a micro mode executing apparatus of a digital still camera having a focus driving motor according to the present invention, and FIG. 4 is a cross sectional view illustrating an expanded state of a maximum optical path of the micro mode executing apparatus of the digital still camera having the focus driving motor according to the present invention.  
20  
25

Referring to FIGs. 3 and 4, the focus driving motor comprises a focusing motor 6 being transferred along a focusing motor spindle 8 by being changed its rotating direction according to an applied electrical signal with reference to the focusing motor spindle, an image sensor module 7, integrally mounted one side of the focusing motor through a fixing member, for converting an image of an object to be photographed to an electrical signal, a focus lens module 5 positioned on a same optical axis as the image sensor module 7 and secured to one end of the focusing motor spindle 8, a housing h consisting of a housing B 2 for limiting a transferring area of the focusing motor 6, a housing A 1 for limiting a transferring area of the focus lens 5, and a barrel structure having a step, a first spring 3 connected to the focus lens module 5 and the focusing motor 6 and having a constant biasing force, and a second spring 4 for positioning the motor on the housing B 2 by applying a biasing force to a lateral direction.

The operation of the micro mode executing apparatus of the digital still camera using the focus driving motor according to the present invention will now be explained.

In case of a typical photograph, as shown in FIG. 3, the image sensor module 7 is fixed on a surface of the housing b 2 by the second spring 4, and the focus lens module 5 is in close to an distal end of the spindle 8 of the



focusing motor 6 by the first spring 1 to bring to a focus along the movement of the spindle of the focusing motor.

At that time, the motor 6 is fixed to the image sensor module 7, and uses a motor movable perpendicular to a rotating surface of the focusing motor spindle 8 in response to the rotation of the focus motor 6.

The first spring 3 serves as a pulling member for attracting the focus lens module 5 and the image sensor module 7, so that the focus lens module 5 moves in close to the focusing motor spindle 8. In addition, the second spring 4 serves as a fixing member for fixing the image sensor module 7 to the surface of the housing B 2 not at the micro mode, while serves as a contacting member for contacting the image sensor module 7 and the focus lens module 5 to the surface of the housing A 1 at the micro mode.

Since the optical system is extended, in order to accomplish the micro mode, the object to be photographed moves gradually toward the lens, so that the focus lens module 5 is in close with the housing A 1. After the focus lens module 5 is in close with the housing A 1, the focusing motor 6 rotates still to compress the second spring 4, thereby moving the image sensor module 7.

Providing the digital still camera using the focus driving motor according to the present invention with the micro mode executing apparatus, the image sensor module 7 is

fixed to the housing B 2 when the micro mode does not use,  
while the image sensor module 7 moves only at the micro mode,  
thereby securing the stable photographing performance.

Also, the image sensor module 7 is driven through the  
5 focusing motor 6, there is not needed a separate driving  
motor for executing the micro mode.

In addition, since the micro mode is executed using the  
focusing motor 6, an auto focusing function using the  
focusing motor 6 can be adopted at the micro mode.

10 While the invention has been shown and described with  
reference to certain preferred embodiments thereof, it will  
be understood by those skilled in the art that various  
changes in form and details may be made therein without  
departing from the spirit and scope of the invention as  
15 defined by the appended claims.